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SMART EMERGENCY RESPONSE SYSTEM FOR REAL TIME ACCIDENT DETECTION AND AUTOMATED REPORTING

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Abstract - *Road accidents continue to be one of the leading causes of fatalities and congestion in rapidly growing nations. Traditional accident detection methods relying on manual monitoring, on-vehicle sensors, or delayed public reporting often fail to provide timely alerts to emergency services, resulting in increased casualties and slower incident response. To address these challenges, this project presents an AI-driven Accident Detection and Alert System that uses the YOLOv8 object detection algorithm to analyze live CCTV footage for real-time accident identification. The system is trained using a custom dataset created from annotated accident video frames, enabling it to accurately detect collision events. Upon detection, an automated alert is sent instantly through the Twilio cloud communication API to emergency services such as ambulance, police, and fire departments. The integration of high-speed AI inference with cloud-based communication ensures rapid response, continuous monitoring, and minimal human involvement.*

Key Words*: *Accident detection, YOLOv8, Twilio, SMS alert, Object Detection

1.INTRODUCTION

With the expansion of urban road networks and the increasing number of vehicles, road accidents have become a critical public safety concern. In countries experiencing rapid urbanization and economic growth, traffic density continues to rise, making timely accident detection more challenging. Conventional surveillance systems depend heavily on manual observation or limited hardware sensors, which often leads to delayed detection, missed incidents, and slower emergency response times. Such limitations significantly increase the risks associated with road accidents, including fatalities, severe injuries, and traffic disruptions.

Advancements in artificial intelligence, deep learning, and computer vision have enabled the development of intelligent transportation systems that are capable of real-time monitoring and automated decision-making. Leveraging these technologies, this project introduces a Smart Accident Detection and Alert System that utilizes the YOLOv8 deep learning model to identify accident scenarios from live CCTV feeds with high accuracy. The model is trained on a custom dataset of annotated accident frames, ensuring it can distinguish between normal traffic movement and collision events.

When the system detects an accident, it seamlessly integrates with the Twilio cloud communication API to deliver instant SMS notifications to emergency responders. This automated alert mechanism significantly reduces the dependency on human reporting and ensures that help is deployed in the shortest possible time. The system operates continuously, provides 24/7 monitoring, and can be scaled across urban and rural surveillance networks. By combining high-performance AI detection with reliable cloud communication, the proposed solution offers a modern approach to improving road safety and accelerating emergency response.

2. PROPOSED SYSTEM

The integrated system combines AI-powered accident detection with cloud-based automated alerting, creating a complete end-to-end emergency response pipeline.

Key Components

1. **Video Processing Unit:** Traffic camera footage is continuously streamed into the system, where each video frame is converted into an analysable format using OpenCV.
2. **YOLOv8 Detection Model:** YOLOv8 Trained on a custom accident dataset built from annotated CCTV accident footage. It detects vehicles, pedestrians, and crash patterns.

3. **Alert Control Module:** When a crash is recognized with confidence, the system forwards the incident details (time, location, detection score) to the alert module.
4. **Twilio SMS Notification:** Twilio's cloud API sends SMS alerts directly to emergency contact numbers. The system ensures that the alert is dispatched within seconds, enabling rapid mobilization of rescue teams.

This architecture ensures automatic detection, zero manual intervention, and fast and reliable alert delivery, making it suitable for deployment across city-wide surveillance networks.

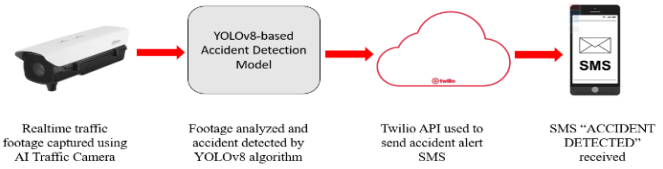

Fig -1: Model Architecture

3. Methodology

3.1 Dataset Creation

A custom dataset was developed using real accident footage collected from public sources.

- Over 1000 frames were extracted using OpenCV.
- Frames were labelled using Labelling, annotating vehicles, pedestrians, and accident events.
- Data augmentation techniques (flipping, colour adjustments, resizing) strengthened the model's robustness to different lighting and weather conditions.

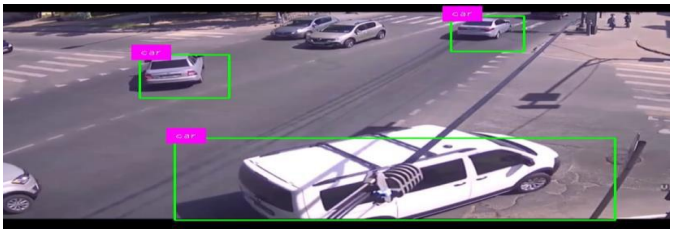

Fig-2: Annotation of mobile objects

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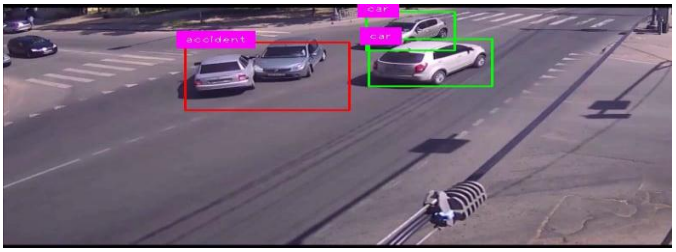

Fig-3: Classification of accident scenario

3.2 Model Training

- YOLOv8 was selected due to its superior detection speed and lightweight architecture.
- Training was performed in Google Colab using GPU acceleration for faster computation.
- The model learned to differentiate between normal traffic flow and accident scenarios.

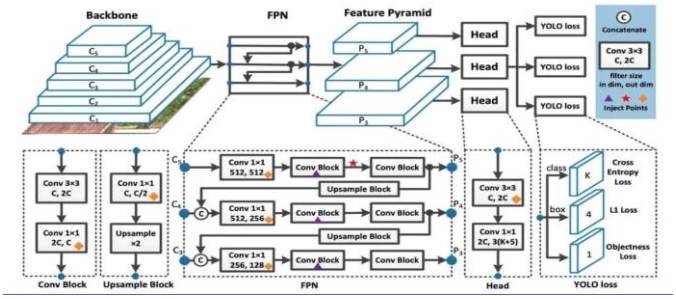

Fig-2: YOLOv8 Architecture

3.3 Real-Time Detection

- The trained model processes live frames in real time.
- YOLOv8 assigns confidence scores to detected objects and identifies collision events.
- If an accident's confidence score exceeds the defined threshold, the alert mechanism is activated.

3.4 Automated Alerting

The alert system uses the Twilio API, which offers:

- Cloud-based, hardware-free messaging
- High reliability and global SMS delivery
- Easy integration with Python

Once triggered, the system sends an SMS containing:

- Accident time
- Location (if integrated with GPS or camera metadata)
- Severity indicator

The event is also logged for audit and analysis.

4. RESULTS

The Accident Detection and Alert System delivered reliable performance during testing. The YOLOv8 model accurately identified accident events in real time, highlighting collision frames with consistent precision. The system maintained smooth video processing with minimal delay and stable frame rates. Once an accident was detected, the integrated alert module automatically triggered an SMS notification within seconds, ensuring rapid communication to emergency contacts. Overall, the system proved efficient, responsive, and capable of operating continuously with high accuracy.

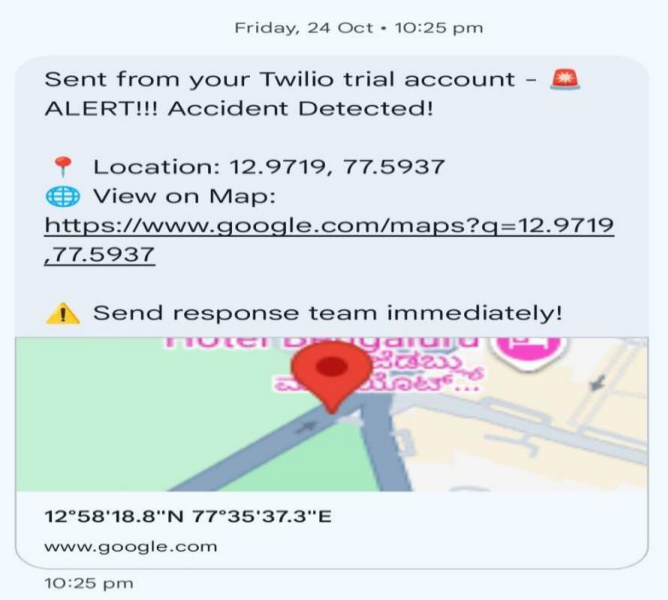

Fig-4: Alert Message

5. CONCLUSION

The project successfully demonstrates an automated accident detection solution that combines real-time video analysis with an instant alert mechanism. By leveraging the speed and accuracy of YOLOv8 along with a cloud-based messaging system, the solution significantly reduces the delay between an accident and emergency notification. The system is scalable, operates without human intervention, and enhances the reliability of traffic monitoring. It offers a practical and modern approach to improving road safety and enabling faster emergency response.

REFERENCES

[1] Sayed A. Sayed, Yasser Abdel-Hamid, Hesham Ahmed Hefny, Artificial Intelligence-Based Traffic Flow Prediction, Springer, 2023, pp. 45-78.

[2] Xueyan Yin et al., Deep Learning for Traffic Prediction: Models, Applications, and Challenges, IEEE Transactions on Intelligent Transportation Systems, IEEE Press, 2020, pp. 789-812.

[3] Wang S., Shao C., Zhang J., Zheng Y., Meng M., Bi-directional Gated Recurrent Unit Model for Traffic Flow Prediction, Journal of Intelligent Transportation Systems, Taylor & Francis, 2022, pp. 145-168.

[4] Waymo & Google AI Team, Integration of Multimodal AI for Real-Time Traffic Prediction in Autonomous Vehicles, IEEE Press, 2024, pp. 200-225.

[5] Huang J., Liu Y., Zhao P., Spatiotemporal Graph Neural Networks for Traffic Flow Prediction, ACM Press, 2021, pp. 99-120.